EQUIPMENT SPECIFICATIONS

SECTION 26 3353 – STATIC UNINTERRUPTIBLE POWER SUPPLY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract.

1.2 SUMMARY

A. This section includes a static, online, uninterruptible power supply (UPS) system consisting of multiple UPS units using VRLA battery energy storage. The UPS equipment will be scalable and modular in nature, sized to meet initial and/or future capacity needs, and incorporate solid-state controls.

B. The UPS equipment is designed for 480 volt, 3-phase, 3-wire, 60 Hz AC input power and 480-volt, 3-phase, 3-wire, 60 Hz AC output power supply.

C. The UPS equipment shall be rated for continuous operation, and operate in conjunction with the building electrical distribution system to provide power conditioning, back-up uninterruptible power, and distribution for critical electrical loads.

1.3 SYSTEM DESCRIPTION

A. UPS System Components: The UPS system shall consist of the following main components.

1. Control logic section including surge suppression, harmonic and noise reduction filters, and electronic monitoring.
2. Sections containing multiple power modules consisting of rectifiers, inverters, DC bus, and static bypass switch.
3. Energy storage devices: Devices providing the uninterruptible power supply to the DC bus.

    a. Batteries mounted within battery cabinets with disconnects.

4. The UPS shall operate in conjunction with building utility power supply(s) and the building back-up generator power supply.
5. The UPS equipment shall directly interface with input and output switchboard assemblies consisting of main UPS input circuit breakers, UPS output breakers, maintenance bypass breakers, system bypass breakers, load bank breakers, and distribution breakers.

B. UPS System Modes of Operation:

1. Double Conversion: The load shall be continuously supplied by the inverter. The inverter shall power the load while regulating the voltage and frequency. Under normal operating

conditions, the rectifier shall derive power from the primary AC power source (utility) and supply DC power to the inverter. At the same time, the rectifier will also provide DC power to charge the batteries.

2. Battery: Upon failure of the primary AC power source (utility), the load shall continue to be supplied by the inverter, which shall automatically obtain power from the batteries. There shall be no interruption to the load following battery operation or during restoration of the primary AC power source. The batteries will supply power to the inverter until exhausted or until the backup generator source is available.
3. Generator: The generator shall provide a secondary backup AC power source to the load should a short or prolonged outage of the primary source occur. Upon the return of the primary AC power source, the UPS shall automatically return to normal operating conditions, and recharge the stored energy devices accordingly.
4. Recharge: Upon restoration of the primary AC power source, the battery charger shall recharge the batteries via the rectifier. The rectifier shall also provide power to the inverter module.
5. Bypass: Should the UPS power modules need to be taken offline and out of double conversion mode due to overload, load faults, or internal failures, the static bypass switch shall automatically transfer the load to the primary AC power supply (utility). This shall be an automatic function and shall cause no interruption to the load. This results in a non-load breaker, internal bypass of the UPS power conversion modules. A return from ‘bypass’ mode to ‘normal’ mode shall also be automatic, and not cause interruption to the load. The system shall be capable of being transferred into or out of bypass mode manually.

1.4 DEFINITIONS

A. ATS: Acceptance Testing Service.

B. EMI: Electromagnetic interference.

C. LCD: Liquid-crystal display.

D. LED: Light-emitting diode.

E. THD: Total harmonic distortion.

F. UPS: Uninterruptible power supply.

G. Ethernet: Local area network based on IEEE 802.3 standards.

H. Firmware: Software (programs or data) that has been written onto read-only memory (ROM). Firmware is a combination of software and hardware. Storage media with ROMs that have data or programs recorded on them are firmware.

I. SNMP: Simple network management protocol. Internet-standard protocol for managing devices on IP networks.

J. I/O: Input/output.

K. LAN: Local area network; sometimes plural as "LANs."

L. LCD: Liquid crystal display.

M. Modbus TCP/IP: An open protocol for exchange of process data.

N. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

O. PC: Personal computer; sometimes plural as "PCs."

P. RS-232: A TIA standard for asynchronous serial data communications between terminal devices.

Q. RS-485: A TIA standard for multipoint communications using two twisted-pairs.

R. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

1.5 ACTION SUBMITTALS

A. General:

B. Product data: For each UPS, battery, remote monitoring interface devices, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes. Include data on overcurrent protective devices, metering and instrumentation, surge suppression, and associated accessories. Include the following:

1. Rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices, and features, location of each field connection, and accessories.
2. Time-current characteristic curves for overcurrent protective devices.

C. Bill of Materials: Provide detailed list of components.

D. Shop Drawings: For each UPS lineup and related equipment, include the following:

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show method of field assembly and location and size of each field connection. Include the following:

a. Overall layout and elevation of lineup.
b. Tabulation of installed devices with features and ratings.

c. Outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.
d. Drawing of cable termination compartments showing locations for conduits and indicating space available for cable terminations.
e. Floor plan drawing showing locations for anchor bolts and leveling channels.
f. Bus configuration with size and number of conductors in each bus run, including phase, neutral, and ground conductors of main and branch buses.
g. Current ratings of buses.
h. Short-circuit ratings of UPS equipment.
i. Nameplate legends.
j. Metering and monitoring wiring system diagram.
k. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
l. Battery arrangement.

2. Wiring Diagrams: For each UPS lineup and related equipment, include power, signal, and control wiring. Include interface with energy storage components.

1.6 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that UPS equipment and associated system components will withstand seismic forces. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity, and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control test reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For UPS equipment and associated system components, provide product data, shop drawings, and test reports in operation and maintenance manuals.

1. Manufacturer’s written instruction for testing, troubleshooting, maintaining, and adjusting equipment.
2. Description of operating sequences.

3. Detailed list of all factory parts, settings, calibration, and instructions.
4. Operating and applications software documentation.
5. Software licenses, where applicable.
6. Software service agreement, where applicable.
7. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.

B. Software and Firmware Operational Documentation:

1. Self-study guide describing the process for setting equipment's network address; setting Government's options; procedures to ensure data access from any PC on the network, using a standard Web browser; and recommended firewall setup.

2. Software or Firmware backup files, where applicable.

1.8 QUALITY ASSURANCE

A. Startup Personnel Qualifications: Engage specially trained personnel who are directly employed by a manufacturer of the UPS system.

1. The work associated with startup of the UPS equipment shall be performed under the supervision of a manufacturer's trained representative.

B. Source Limitations: Obtain UPS equipment and associated system components through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of UPS equipment and are based on the specific system indicated

D. Each UPS system component (such as UPS unit and UPS batteries) shall be fully assembled, inspected, and tested at each respective factory prior to shipment. Large line-ups shall be split to permit normal shipping and handling as well as for ease of rejoining at the job site.

E. Electrical components, devices, and accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency accepted by the authority having jurisdiction, and marked for intended location and application; listed as a complete assembly.

1. UL label and local testing (where required

F. Comply with NFPA 70, National Electric Code.

1.12 REFERENCES

A. ANSI/IEEE 519 – Guide for Harmonic Control and Reactive Compensation of Static Power Converters.

B. FCC 47 CFR Part 15 – Radio Frequency Devices.

C. IEC 62040 – Uninterruptible Power Systems (UPS).

D. UL 508 – Standard for Industrial Control Equipment.

E. UL 1004 – Standard for Motor Generator Equipment.

F. UL 1778 – Standard for Uninterruptible Power Supply Equipment.

1.13 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Government of other rights Government may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Battery Warranties: Specified form in which manufacturer agrees to repair or replace UPS system batteries that fail in materials or workmanship within specified warranty period:

1. Warranted Cycle Life for Premium, Valve-Regulated, Lead Acid (VRLA) batteries: Manufacturer's standard product warranty.

C. Special UPS Warranties: Specified form in which manufacturer agrees to repair or replace UPS components that fail in materials or workmanship within specified warranty period:

1. Special Warranty Period: 24-months (Two years) from date of delivery.
2. Warranty shall include all parts and labor with no deductible.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with product and physical space requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. APC, Schneider Electric
2. Liebert Corporation; a division of Emerson Network Power
3. Powerware, Eaton Corporation (Basis of Design – Power Xpert 9395 Series)
4. Or approved equal

2.2 GENERAL REQUIREMENTS

A. Description: The full build-out of the UPS system shall be capable to be arranged with four (4) UPS assemblies providing a total system capacity of 1500kW rated output power for 20 minutes, and configured as indicated on the drawings. One UPS unit will pair with a second redundant UPS unit to support 750kW. A third UPS unit will pair with a fourth redundant UPS unit to support another 750kW.

1. Equipment shall consist of one (1) complete UPS assembly.
2. Configuration: Each UPS assembly shall consist of a modular design and construction. The modular design shall include multiple power conversion modules. Each module shall operate independently, where the system design shall demonstrate fault tolerance and failure of any one module.
3. Redundancy: Each UPS assembly shall have the number of power modules required to support the rated output load plus one additional, redundant module.

B. UPS System Ratings:

1. Nominal System Capacity: Each UPS shall be sized for a total output load capacity of 750kW (minimum). Higher ratings are acceptable where manufacturer’s standard capacity components vary.
2. Nominal System Input Voltage: 480-volt, 3-phase, 3-wire.
3. Nominal System Output Voltage: 480-volt, 3-phase, 3-wire.
4. UPS Energy Storage Capacity:

    a. The UPS batteries shall be sized to support the full load kW output rating of each UPS lineup for the duration of 20-minutes.

C. Overall footprint of UPS assembly and associated system components shall fit within maximum dimensions indicated on drawings and physical space constraints of UPS room without compromising minimum code clearances.

D. Equipment shall be UL-1778 listed and labeled, and shall be designed, manufactured, factory-assembled, and tested in accordance with NEMA and ANSI standards.

2.3 PERFORMANCE REQUIREMENTS

A. The UPS shall perform as specified in this article while supplying rated full-load current, composed of any combination of linear and nonlinear load, up to 100 percent nonlinear load with a load crest factor of 3.0, under the following conditions or combinations of the following conditions:

1. Inverter is switched to battery source.
2. Steady-state ac input voltage deviates up to plus or minus 10 percent from nominal voltage.

3. Steady-state input frequency deviates up to plus or minus 5 percent from nominal frequency.
4. Load is 100 percent unbalanced continuously.

B. Minimum Duration of Supply: Full UPS load current at minimum 80 percent power factor for a duration of time as indicated on drawing for each separate UPS.

C. Input Voltage Tolerance: System steady-state and transient output performance remains within specified tolerances when steady-state ac input voltage varies plus 10, minus 15 percent from nominal voltage.

D. Overall UPS Efficiency: Equal to or greater than 92 percent at 100 percent load.

E. Maximum Acoustical Noise: Not more than 85 dBA, "A" weighting, emanating from any UPS component under any condition of normal operation, measured three feet (1 meter) from nearest surface of component enclosure.

F. Maximum AC Output-Voltage Regulation for Loads up to 50 Percent Unbalanced: Plus or minus 2 percent over the full range of voltage.

G. Output Frequency: 60 Hz, plus or minus 0.5 percent over the full range of input voltage, load, and battery voltage.

H. Limitation of harmonic distortion of input current to the UPS shall be as follows:

1. Description: Either a tuned harmonic filter or an arrangement of rectifier circuits shall limit THD to 7 percent, maximum, at rated full UPS load current, for power sources with X/R ratio between 2 and 30.

I. Maximum Harmonic Content of Output-Voltage Waveform: 5 percent rms total and 3 percent rms for any single harmonic, for 100 percent rated nonlinear load current with a load crest factor of 3.0.

J. Minimum Overload Capacity of UPS at Rated Voltage: 110 percent of rated full load for 10 minutes, and 150 percent for 10 seconds in all operating modes.

K. Maximum Output-Voltage Transient Excursions from Rated Value: As defined in IEC 62040-3.

L. Input Power Factor: A minimum of 0.90 lagging when supply voltage and current are at nominal rated values and the UPS is supplying rated full-load current.

M. EMI Emissions: Comply with FCC Rules and Regulations and with 47 CFR 15 for Class A equipment, or as defined in IEC 62040-3.

2.4 UPS COMPONENTS

A. Power Conversion Modules: The UPS assembly shall consist of multiple power modules, each consisting of the following:

1. Rectifier / Charger: Each rectifier/charger shall convert incoming AC power to regulated DC output for supplying the inverter and for charging the battery. The rectifier/charger shall be a high-frequency, pulse-width-modulation (PWM) design, using Insulated Gate Bi-polar Transistors (IGBTs). The modular design of the UPS shall permit safe and fast removal and replacement of the rectifier/charger module. Mean Time To Repair (MTTR) for the module shall be no more than 30 minutes in order to return UPS to normal mode. The rectifier/charger module shall also provide the following:

    a. The rectifier shall be capable of drawing power from the utility with a power factor of 0.99 under nominal conditions.
    b. The rectifier shall feature protection circuitry that prevents the IGBTs from sourcing current in excess of their published ratings.
    c. The rectifier shall be capable of operating from a delta transformer output or high impedance grounded transformer.
    d. Input Current Total Harmonic Distortion: The input current THD shall be held to no more than 5 percent while providing conditioned power to the DC bus, and while charging the energy storage devices.

2. Inverter: Each inverter shall feature an IGBT pulse-width-modulation (PWM) design with high speed switching. The inverter shall also have the following features:

    a. The inverter shall be capable of providing the specified quality output power while operating from any DC source voltage (rectifier or battery) within the specified DC operating range.
    b. The modular design of the UPS shall permit safe and fast removal and replacement of the inverter module. Mean time to repair (MTTR) for the module shall be no more than 30 minutes in order to return UPS to normal mode.
    c. The inverter shall feature protection circuitry that prevents the IGBTs from sourcing current in excess of their published ratings.

3. Static Bypass: Solid-state, high speed switching device providing uninterrupted transfer from inverter output to the static bypass input source and back. The bypass shall be fully rated for continuous operation. Provide overcurrent protection and system isolation to each input of the switch.

    a. Transfers shall occur automatically when the inverter output characteristics cannot support the load. Such conditions include system output overload, bus voltage variations, internal over-temperature, complete energy storage discharge, or any UPS failure. Automatic retransfer shall occur when the system is capable of re-assuming the load.
    b. Transfers shall be initiated manually via the UPS control panel interface when maintenance is required, or when unacceptable power conditions are predicted.

B. Monitoring and Controls: Microprocessor-based control circuitry.

1. Control power shall be served from redundant power supply units.
2. Display Interface: The UPS control panel shall have a digital, LCD touch screen display capable of displaying metered and monitored UPS system characteristics, controlling UPS operation, and adjusting various UPS system settings.

    a. Mimic Bus: Display shall show a graphical representation of the system reflecting power flow, component status, metered values, and other key system attributes.
    b. The following functions shall be accessible from the touch screen display:

        1. Metered Data including input and output and bypass current, voltage, THD, real and apparent power, power factor, frequency; DC current, voltage, and power; estimated energy storage run time; system temperatures.
        2. Events and alarms including historical time-date log of system failures and other key system events. System or component errors, warnings, failures, shutdowns, faults, and overloads shall be displayed.
        3. Controls including the selection of operational mode: normal, bypass, charger on/off, power module on/off.
        4. Setup variables including date and time information, system variables, firmware information,
        5. Access to Owner’s Manual or other step-by-step operational instructions.

3. Status Indicating Lights: The UPS shall have separate LED indicating lights mounted to the front of the unit reporting the following monitoring functions:

    a. Normal Operation: Indication that the primary AC service (utility) or backup generator source is supplying power to the rectifier and the inverter is supporting the load.
    b. Bypass: Indication that the UPS has transferred the load to the bypass input source.
    c. Battery: Indication that the UPS is supplying power to the load via battery energy storage devices.
    d. Alarm: Indication that the UPS control logic has detected an alarm condition.

C. Ventilation and Cooling: Each power module shall contain redundant cooling fans to remove heat from the assembly. Ambient air shall enter the bottom front of the UPS assembly, and air outlet shall be through the top of the assembly.

D. Surge Suppression: Provide transient voltage surge suppression as defined in IEEE 587.

2.5 BATTERY ENERGY STORAGE

A. Description: Battery energy storage system shall consist of premium valve-regulated, lead acid (VRLA) batteries mounted in battery cabinet system and battery management and monitoring system.

1. Battery Runtime: Battery system shall be sized to carry the full output load of each UPS for 20-minutes.

B. Battery Type: Valve-regulated, lead acid (VRLA), high-rate discharge, designed specifically for UPS and reserve energy applications. Units shall have bolted lead plate copper connectors; be in styrene acrylonitrile containers; and mounted sealed acid resistant enclosure.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C&D Technologies, Inc.; Standby Power Division
b. EnerSys (Basis of Design)
c. Panasonic Corporation of North America; Panasonic Industrial Company.
d. Or approved equal.

2. Battery Performance: (Based on DataSafe HX16-FT series)

a. Capacity: Nominal 925 watts/cell based on 15-minute constant power discharge rate and 1.67-volts per cell at 25°C (77°F).
b. 8-cell, 16-volt, 1.215 specific gravity
c. Design life: 10 years at 25°C (77°F).
d. Rated at 100 percent capacity at initial discharge.
e. Float voltage: 2.25 – 2.28 volts per cell.
f. Equalization voltage (charging): 2.40 volts per cell.
g. The batteries shall meet UL 94 flame retardant requirements, utilizing polypropylene container and cover materials.

3. Connection: Front terminal access.
4. Mounting: Batteries shall be cabinet-mounted in integrated battery cabinet system.

C. Battery Cabinet System:

1. Construction: Vertical cabinet, with steel member framing; hinged front doors, lockable; casters. Each battery cabinet shall require front access only for installation, service and maintenance.

a. DC power distribution via tin-plated, copper busbars.
b. Front terminal connections to battery terminals.

2. Seismic-Restraint Design characteristics: Cabinets and associated components (and fastenings and supports, mounting, and anchorage devices for them) shall be designed and

fabricated to withstand static and seismic forces. Rated for UBC seismic Zone 4 installation.

3. Configuration: Multi-shelf design designed to satisfy the loading requirements for the batteries; jumper cabling between busbars.

    a. Power wiring internal to each battery cabinet shall be factory provided. Each battery cabinet shall feature battery trays which can be individually disconnected from the battery cabinet power wiring with quick disconnect devices. Each battery tray shall be firmly secured to the battery cabinet frame with fasteners. Each battery tray shall be removable from the front of the battery cabinet.

4. Cable Entry: The battery cabinet shall be configured for top cable entry.
5. Overcurrent protection: Each battery cabinet shall feature a DC rated circuit breaker, sized for battery string output. The circuit breaker within the battery cabinet shall only provide protection to the battery string within that battery cabinet. For battery configurations involving multiple battery cabinets, a battery string in one battery cabinet may be isolated from the DC link via its circuit breaker without removing other battery strings from the DC link and the UPS module.

    a. Voltage rating: 500 Vdc nominal, 600 Vdc maximum.
    b. Amperes interrupting rating: 25,000A.
    c. UL 489 listed.
    d. Low-magnetic trip setting.

6. Shunt Trip and Dual Auxiliary Contacts: The circuit breaker in each battery cabinet shall feature a 48VDC shunt trip release device. The shunt trip device shall operate to trip the battery breaker(s) for an emergency power off command or battery disable command.
7. Complete system shall be UL-1778 listed.

D. Battery Management and Monitoring System: A battery management and monitoring system shall be arranged to manage and monitor individual cells of the UPS system batteries. The system shall monitor various battery parameters, automatically perform periodic resistance tests, and assess operating integrity of the connected battery.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Albercorp
    b. BTech, Inc.
    c. Powerware; a division of Eaton Corporation.
    d. Or approved equal.

2. The battery monitoring system shall perform the following functions:

a. System shall monitor, record data and provide alerts on battery string voltage, cell/jar voltage; individual cell/jar temperature.
b. System shall monitor ambient room temperature, float, and battery string discharge currents.
c. System shall enable trend analysis of battery performance using impedance measurements.
d. System shall sense DC discharges due to insufficient AC power; record and archive total battery, unit voltage decay, and current during a discharge.

3. The battery monitoring system shall be self-contained system and function independently of remote interface. The unit shall provide alarms, record and store data, and have means to communicated stored information to remote monitoring system or building management network.

E. Load Test: UPS should have the ability to perform a full load test in double conversion mode without the connection of a load bank.

2.6 EXTERNAL MAINTENANCE BYPASS

A. The UPS system shall have the mechanical means to bypass and isolate the UPS equipment while still supporting the loads. The maintenance bypass feature shall provide complete isolation of the UPS units from the AC power source.

1. Maintenance bypass shall be incorporated by mechanically and electrically interlocking devices to prevent interrupting power to the load when switching to and from maintenance bypass mode.

B. Maintenance bypass feature shall be incorporated into UPS input and output switchboard sections. Refer to one-line diagram and Division 26 Section “Switchboards” for additional information.

2.7 UPS EQUIPMENT FABRICATION

A. Enclosure: NEMA 1, indoor enclosure. Enclosure and internal barriers shall be fabricated of steel members.

B. Finish: Manufacturer's standard finish over rust-inhibiting primer on phosphatizing-treated metal surfaces

C. Sections shall be capable of being bolted together, and bolted to a concrete foundation pad using anchor bolts.

D. Furnish each unit with a master nameplate, metal stamped, listing standard manufacturer information including voltage, ampacity, frequency, and short-circuit ratings; manufacturer’s model and project designations.

2.8 SYSTEM MONITORING AND MANAGING

A. Description: Provide communications interface with capabilities to monitor the following system components:

1. Uninterruptible Power Systems.
2. Power Distribution Units.
3. Battery Energy Storage.
4. Power Distribution Breakers.

B. Utilize Modbus TCP/IP or SNMP over the governments Ethernet network.

C. Communications interface shall allow the following functions to be accessed including:

1. Collect and view real time data.
2. Continuous monitoring.
3. Display and Storage
4. Alarm notification.
5. Equipment alarms and historical trend data.
6. View power circuit breaker trip curves and set point controls.

D. Provide interface devices on non-compatible system components to operate on the monitoring and managing system via SNMP or Modbus TCP/IP

2.9 SOURCE QUALITY CONTROL

A. Before shipment of equipment, perform standard factory tests and prepare test reports:

B. Assemble UPS batteries and associated system components in each manufacturer's plant and perform the following:

1. Functional tests of all instruments, meters, and control devices by application of secondary three-phase voltage to voltage circuits and injection of current in current transformer secondary circuits.
2. Functional test of system controls. Connect test devices into circuits to simulate operation of control features including transfer sequences.

C. Prepare equipment for shipment.

1. Provide suitable crating, blocking, and supports so equipment will withstand expected domestic shipping and handling shocks and vibration.
2. Weatherproof equipment for shipment. Close connection openings to prevent entrance of foreign material during shipment and storage.

PART 3 - EXECUTION

3.0 FACTORY TESTING

A. Before shipment, the UPS equipment and other system components and accessories manufactured specifically for this project shall undergo standard factory testing.

1. Manufacturer shall perform a complete operational test on the UPS prior to shipping from the factory. Tests shall be in accordance with ANSI and NEMA standards as well as described in NETA ATS.
2. The manufacturer shall provide three certified copies of factory test reports.

3.1 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect UPS system installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.
2. Complete installation and startup checks according to manufacturer’s written instructions.
3. Assist in field testing of equipment including pretesting and adjusting of equipment and components.
4. Report results in writing.

3.2 DEMONSTRATION

A. Provide operating instructions.

B. Engage a factory-authorized service representative to train Government’s maintenance personnel to adjust, operate, and maintain UPS system. Training shall include the following:

1. Testing and adjusting of controls and safeties.
2. Start-up and shutdown procedures.
3. Review of operation and maintenance manual, and a highlight of typical procedures.
4. Review of safety procedures, UPS operational theory, system controls, and preventative maintenance.

C. Provide a period of at least 16 hours instruction to operating personnel. This period should consist of four 4-hour periods.

END OF SECTION 26 3353